TREATMENT OF BIODEGRADABLE WASTE – CASE OF NOVI SAD REGION

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Abstract
Main driver for the development of waste management system in waste management regions in Serbia, will be transposition of the European waste management directives. Implementation of Landfill Directive will have a great impact on management of biodegradable waste and reducing the waste disposed at landfill. Composting and anaerobic digestion are proven technologies for treatment of biodegradable waste. Selection of treatment of biodegradable waste will depend on many factors, but must be tailored to local conditions.

Introduction
The municipal waste management landscape in Serbia will go through the changes, especially with regard to its waste policies and legislation. Serbia is a candidate country for European Union membership (EU), and so will have to transpose and implement the total body of EU legislation. The directive regulating management of biodegradable municipal solid waste in the European Union is the Landfill Directive. The Landfill Directive propose the targets for reduction of biodegradable waste which is sent to the landfill from 75% of 1995 baseline levels by 2010, 50% of 1995 baseline levels by 2013 and 35% of 1995 baseline levels by 2020 [1]
The Landfill Ordinance [2] is actually a transposition of the Landfill Directive and require the reduction of biodegradable municipal waste (BMW) sent to landfill by 25%, 50% and 65% in the year 2016, 2019 and 2026 respectively.
Waste management in Serbia, is still focused on waste collection and protection of public health. Main deficiencies in solid waste management are weak and inefficient law enforcement mechanism, lack or weak capacity or motivation of staff, lack of finances for investments, lack of incentives for both local community and for the citizens. Dominant waste treatment method is still landfilling with high share of biodegradable municipal waste (BMW) going to landfill, like in South Eastern Europe countries [3][4]. Regarding the packaging waste, almost all waste from the household which is sent to recycling is collected by an informal sector. Separate collection is not established in Serbia as well.
Based on experience of EU Member States where the disposal of waste remained cheap, and where there are no fees and charges for waste disposal, diversification of biodegradable waste from landfills and implementation of waste treatment technologies has been more slowly, unlike in countries where fee for waste disposal was introduced prior to LD implementation, and thus gradually started to build the necessary infrastructure for waste management [5]. In addition, new member states e.g. Poland, Bulgaria, Romania, Croatia, still depend on landfilling, and treatment options are rarely in place. Therefore still a large amount of biodegradable waste is disposed of in landfills
The transposition and implementation of the Directive provisions legislation will be an extremely challenging task for the country. The aim of this paper is to identify the amount of BMW and the treatment process in order to fulfill the LD provisions and divert the BMW from landfill in Novi Sad Waste Management Centre (NSWMC).

Experimental

The input for the analysis is morphological composition of MSW in NSWMR and generated MSW waste. In 2009. total amount of generated waste was 189.000 tonnes [6]. Out of this, 44% is biodegradable waste (see Figure 1).

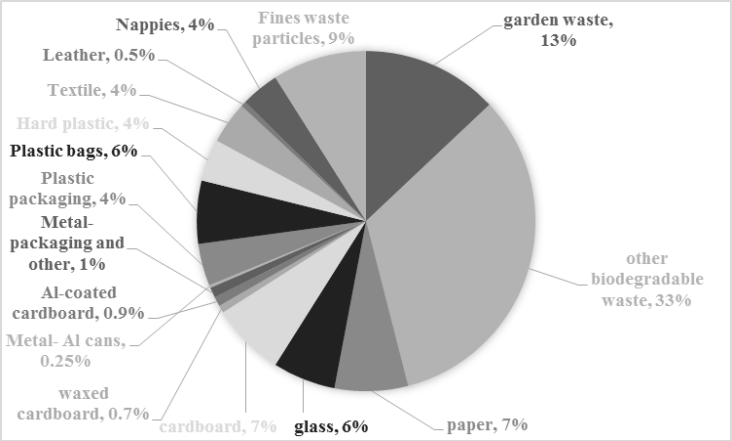

Figure 1: Morphological composition of MWS in NSWMR [6]

For the projected waste generation growth rate we have used GDP in Serbia, which was around 2% [7].Due to the Landfill Directives requirements, composting and anaerobic digestion are used for the treatment of the biodegradable fraction. Composting considers open-air process in a box, which include composting and the stage of maturation. Compost, wastewater and residues are produced during the process. Biogas, wastewater and a digestion residue are produced during the anaerobic digestion. The biogas is combusted to produce electricity and heat; the residues are further treated in the aerobic maturation process stage, producing compost.

Table 1: Analzsed technologies for the BMW treatment [8,9,10]

Technology	Mass balance	
Composting	Compost	35%
	Residues	7%
	Wastewater	43%
	Off'-gases	15%
Anaerobic digestion CHP	Biogas	15%
	Compost	30%
	Residues	7%
	Wastewater	48%

Results and discussion

In 2035. total amount of generated municipal waste will be 322,769 tonnes with 2% increased rate. In order to comply with Landfill Directive, it would be necessary to treat 96,506 tonnes of biodegradable waste in composting plant or anaerobic digestion plant. Outputs of the analysed technologies are given in Table 2. Both treament technologies produce compost which can be sold and wastewater which need to be treated. In addition, during the anaerobic digestion process biogas is generated, which is used for production of electricity and heat. Production of energy,

could contribute to increase of revenues for the plant.

Table 2: Biodegradable waste treatment output's

	Anaerobic digestion	Composting
From treatment plant (tonnes year^{-1})		
Biogas	14,476	-
Compost	28,952	33,778
Wastewater	46,324	55,972
Residues for landfill	6,756	6,756

Selection of waste treatment plant will depend on many factors. One of the important factors will be the investment cost of the plant and economic sustainability of the plant. However, treatment of biodegradable waste must tailored to local conditions.

Conclusion

Anaerobic digestion and composting are proven waste treatment technologies for BMW. Implementation of those technologies will be challenging task for the region. Decision makers will have to implement and introduce different mechanisms e.g. landfill ban, landfill taxes in order to divert BMW from the landfill and fulfill the Landfill Directive goals.

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